



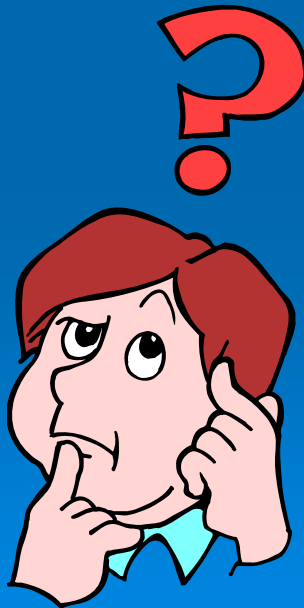
# UNSOLVED IH MYSTERIES

CHALLENGES AND  
SCIENTIFIC INTRIGUES  
FOR THE FUTURE



# A COLLECTION OF SHORT SUBJECTS

For the inquiring minds of health and safety professionals.



- **Ototoxins**-Have you heard the news?
- H is for Hazards at **Hospitals**
- **Infectious disease** is spreading—into IH
- **Methamphetamine**-Wiping the problem away
- **Nanotechnology**-A very small subject

# OTOTOXINS—HAVE YOU HEARD THE NEWS?

.....Chemicals can cause hearing loss.



**NO WAY!**

- **Noise** is the hazard normally associated with occupational hearing loss.
- Health and safety researchers are giving increased attention to a lesser known threat---

**OTOTOXINS.**

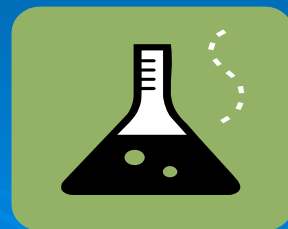
# OTOTOXINS

- Like other chemicals, ototoxins gain entry into the body through inhalation, ingestion, and skin absorption.
- Once in the bloodstream, ototoxins target the **auditory nerve and cochlear hair cells** in the inner ear.
- Damage includes ringing in the ears, mild hearing loss, or profound deafness.

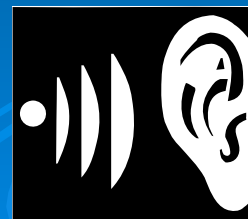


# US ARMY CENTER REPORTS

- Inhalation of some chemicals may cause hearing loss **independent** of noise exposure.
- Other chemicals have **additive** or **synergistic** effects with noise exposures to potentiate noise-induced hearing loss.



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# NIOSH LIST OF HIGH PRIORITY OTOTOXINS

- Toluene
- Xylenes
- Styrene
- n-Hexane
- Mixtures of the above
- Trichloroethylene
- Lead and derivatives
- Carbon monoxide
- Alcohols

# NIOSH LIST OF OTHER OTOTOXINS

- Mercury and derivatives
- Methylene chloride
- Butyl nitrite
- Arsenic
- Carbon Disulfide
- Benzene
- Atoxyl
- Cyanide
- Cobalt
- Manganese

# WHILE THE RESEARCH CONTINUES...

- Health and safety professionals need to be diligent to protect the hearing of workers exposed to ototoxic chemicals using fundamental principles of industrial hygiene.

**Recognition**-Be familiar with chemicals on the NIOSH ototoxin lists.

**Evaluation**-Closely evaluate workers' exposure levels to ototoxic chemicals.



# EVALUATION METHODS

Many of the organic solvents on the NIOSH ototoxin lists can be sampled using 575-series passive samplers. These samplers have been validated to confirm sampling reliability.



Cat. No. 575-series

# SAMPLER VALIDATIONS

## OSHA VALIDATIONS

- Toluene-OSHA 111
- Xylenes-OSHA 1003
- Trichloroethylene-OSHA 1001
- Benzene-OSHA 1005

See [www.osha.gov](http://www.osha.gov)

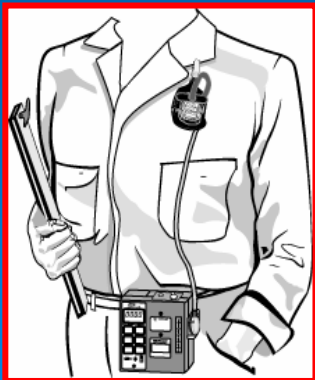
## SKC VALIDATIONS

- Hexane
- Methylene Chloride
- Styrene

See [www.skcinco.com](http://www.skcinco.com)

# EVALUATION METHODS

Metal particulates on the NIOSH ototoxin lists can be sampled using standard filter collection methods.



- Lead and derivatives
- Cobalt
- Manganese
- Arsenic
- Particulate Mercury

# OTOTOXIN CONTROL STRATEGIES

1. Take steps to reduce ototoxin exposures through all exposure routes.
2. Conduct yearly audiograms for workers exposed to ototoxins when typical exposures are at 50% of the OEL.
3. Be aware of the combined effects of noise and chemicals on hearing loss and closely review audiometric test data.

# FOR MORE INFORMATION

- NIOSH Topic Page

[www.cdc.gov/niosh/topics/noise/research/noiseandchem/noiseandchem.html](http://www.cdc.gov/niosh/topics/noise/research/noiseandchem/noiseandchem.html)

- US Army Center

<http://chppm-www.apgea.army.mil>

# “H” IS FOR HAZARDS AT HOSPITALS



# CHEMICAL HAZARDS IN HOSPITALS

## HISTORICAL STERILIZING AGENTS

- Ethylene oxide
- Glutaraldehyde

## ANESTHETIC GASES

- Enflurane
- Halotane
- Isoflurane

## NEW HAZARDOUS DRUGS

- Chemotherapy
- Anti-viral
- Hormones
- Bioengineered drugs

# EVALUATION METHODS

## ETHYLENE OXIDE

- Passive samplers containing a hydrobromic acid coated charcoal can be used to assess TWA or STEL exposures.
- This is the sorbent specified in OSHA Method 50.



SKC Cat. No. 575-005

15-min to 8-hr sampling



# EVALUATION METHODS

## GLUTARALDEHYDE

- Cassettes containing 2 glass fiber filters treated with 2,4-DNPH and phosphoric acid can be used at flow rates up to 2 L/min to assess short-term (5-15 min) or long-term (4-hr) exposures by OSHA 64.



SKC Cat. No. 225-9003

# EVALUATION METHODS

## ANESTHETIC GASES

- Sorbent tubes containing either Anasorb CMS or Anasorb 747 sorbent can be used to assess short-term (15-min) or long-term (2-hr) exposures by OSHA 103.



SKC Cat. No. 226-121  
or 226-81A

# EVALUATION METHODS

## HAZARDOUS DRUGS

- NIOSH has been studying sampling methods using OSHA Versatile Samplers to trap both phases.



SKC Cat. No.. 226-30-16  
or 226-56/58

# FOR MORE INFORMATION

## NIOSH Documents

- Antineoplastic Agents-Occupational Hazards in Hospitals

[www.cdc.gov/niosh/docs/2004-102/](http://www.cdc.gov/niosh/docs/2004-102/)

- Preventing Occ Exposure to Haz Drugs

[www.cdc.gov/niosh/docs/2004-165/](http://www.cdc.gov/niosh/docs/2004-165/)

# INFECTIOUS DISEASE IS SPREADING INTO IH

## HISTORICAL KNOWN PATHOGENS

- Bacteria
- Viruses
- Fungi
- Other known microorganisms

## NEW UNKNOWN OR UNCOMMON PATHOGENS

- SARs
- Bird Flu
- Anthrax

# EVALUATION METHODS

## BACTERIA

- Assessment requires growth culture or PCR DNA-based analysis
- Viable cascade impactors can be used according to NIOSH 0800 and 0801 for short-term samples.



SKC Cat. No. 225-9611

# EVALUATION METHODS

## VIRUSES

- ACGIH reports that air sampling for viruses is not routinely done for IEQ studies.
- Viruses do not remain long in the environment and do not multiply alone on organic substrates.
- Sampling is done to research **transmission** of airborne viral diseases.
- This technique was used by NIOSH during SARs response.

# EVALUATION METHODS

- The evaluation method chosen to collect viral samples depends on the virus itself, the environmental conditions, and the analysis techniques available.



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# HEALTH AND SAFETY PROFESSIONALS



SAVING THE WORLD  
FROM EMERGING HAZARDS

# METHAMPHETAMINE (MA): WIPING THE PROBLEM AWAY

Health and safety professionals have a role to play in the response and cleanup from clandestine methamphetamine “laboratories”.



# IH ROLE IN MA LABS

- To protect first-responders and other personnel from the hazards
- To develop health and safety plans for decontamination of buildings/environment
- To confirm that appropriate “safe” levels have been met prior to reoccupancy



# OCCUPATIONAL HAZARDS OF METHAMPHETAMINE (MA)

## WHO?

- Law enforcement
- Fire, Haz-Mat, or ambulance crews
- Social services
- Utilities services
- Landlords

## WHERE?

- Homes
- Cars
- Hotel Rooms
- Storage units
- Dumpsters
- Tents/Campsites

# CHEMICAL HAZARDS IN MA PRODUCTION

RED

PHOSPHORUS

METHOD

- Iodine
- Sodium hydroxide
- Sulfuric acid
- Phosphine

NAZI

COLD LABS

METHOD

- Ammonia
- Sulfuric Acid
- Hydrocarbons



# ASSESSING THE RISKS

## Step 1-Information Gathering

- Conduct interviews with law enforcement personnel and examine records.

## Step 2-Walkthrough Inspection

- Wear PPE including respirators, gloves, and lab coat

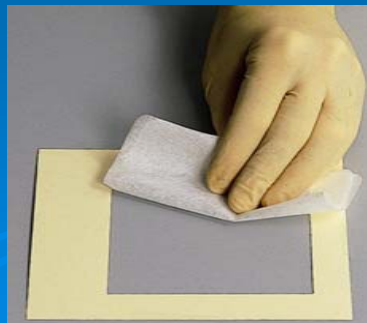


# SAMPLE COLLECTION

- NIOSH reports that **air** sampling for individual contaminants is only effective during active “cooking” of MA.
- The particulate aerosol formed during MA production however deposits onto available surfaces.
- A better method for sampling MA is **surface wipe** sampling.

# NIOSH SURFACE WIPE METHODS FOR MA

- NIOSH will be publishing two new surface wipe methods with GC/MS analysis: Methods 9106 and 9109.
- SKC plans to introduce a NIOSH technology for colorimetric surface wipes at AIHCE in May.





# SITE REMEDIATION

- Removal of all the furnishings and replacing HVAC system
- Extensive cleanup of walls and all surfaces where chemical residues can be present
- Followed by evaluation of surface levels of MA residue and comparison to appropriate regulations for reentry

# NANOTECHNOLOGY

## A VERY SMALL SUBJECT

### DEFINING NANOTECHNOLOGY

- Engineered structures, devices, and systems with materials of a nanoscale size from 1-100 nm.
- Nanoscale materials are being used in electronics, magnetic, medical imaging, drug delivery, catalytic and materials applications, and consumer products.

# EXAMPLE: NANOTUBES

- Compressed carbon: The hardest material ever made by the human race
- Can be woven into a hollow pipe and filled with “payload molecules”
- Applications include lightweight, fireproof, and earthquake-proof buildings
- Levees as thin as Saran Wrap that are impervious to surges

# NANOPARTICLES (NP)

- **Engineered NP**-Larger surface to mass ratio which allows them to bind, adsorb, and carry other compounds such as drugs, probes, and protein
- **Combustion NP**-Produced unintentionally in diesel exhaust and other combustion processes. Also called ultrafine particles defined as nano-sized particles *in air*.

# AERODYNAMIC BEHAVIOR

## Particle size

### determines:

- Airborne status
- Inhalability
- Deposition site in respiratory system
- Efficiency with which particles are captured and filtered by the body

## Nanoparticles

- Remain airborne for long periods of time
- Enter the body with high efficiency and deposit in all regions of the respiratory system
- Main mechanism of deposition is diffusion
- Behavior is more like that of a vapor

# NP EXPOSURES

- Nanomaterials are initially produced as aerosols or colloidal suspensions.
- Exposure to these materials during manufacturing and use may occur through inhalation, dermal contact, and ingestion.
- There are also indications that NP can translocate from the respiratory system to other organs.

# HEALTH EFFECTS OF NPs

- Materials may have a low hazard potential as larger particles, but be toxic in the form of NPs.
- The **small size and surface chemistry** of NPs may impair or render less effective the natural protective mechanisms of the human body.
- Adverse respiratory, cardiovascular, and CNS effects may result from NP exposures.

# EVALUATION

- Currently, particulate exposures are evaluated using **mass** concentrations.
- This may not be the right choice for NPs.
- **Particle number and/or surface area** may be more appropriate parameters.
- It may be possible however to use mass concentration as a surrogate measurement if information on particle size distribution or surface area is known.



# FOR MORE INFORMATION

## ➤ NIOSH

[www.cdc.gov/niosh/topics/nanotech/](http://www.cdc.gov/niosh/topics/nanotech/)

## ➤ UK HEALTH AND SAFETY EXECUTIVE

[www.hse.gov.uk/research/rrhtm/rr274.htm](http://www.hse.gov.uk/research/rrhtm/rr274.htm)

# THANK YOU FOR YOUR ATTENTION!

